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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/630,969

07/31/2003

David L. O'Meara

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EXAMINER

BERRY, RENEE R

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 09/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

1

Office Action Summary

Application No.

10/630,969

Applicant(s)

O'MEARA ET AL.

Examiner

Renee R Berry

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) 32-54 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,261,934 to Kraft in view of US Patent No. 6,498,097 to Park et al.

In regards to claim 1, Kraft teaches a method of forming a semiconductor microstructure, the method comprising: positioning a substrate in a process chamber; flowing a process gas comprising an oxygen-containing gas in the process chamber; and forming an oxide layer on the substrate, the layer being formed in a self-limiting oxidation process, wherein the partial pressure of the oxygen-containing gas in the process chamber at column 10, lines 64-67, claim 7.

In regards to claim 2, Kraft teaches the method according to claim 1, Kraft wherein the thickness of the oxide layer is less than about 15 Angstroms at column 6, lines 56-65.

In regards to claim 3, Kraft teaches the method according to claim 1, wherein the thickness of the oxide layer is less than about 10 Angstroms at column 6, lines 56-65.

In regards to claim 4, Kraft teaches the method according to claim 1, wherein the thickness uniformity of the oxide layer varies less than about 1 Angstroms over the substrate at column 6, lines 56-65.

In regards to claim 17, Kraft teaches a method of forming a semiconductor microstructure, the method comprising: positioning a substrate containing an initial dielectric layer in a process chamber; flowing a process gas comprising an oxygen-containing gas in the process chamber; and forming an oxide layer with high thickness uniformity, the oxide layer being formed between the initial dielectric layer and the substrate in a self-limiting oxidation process at column 10, lines 64-67, claim 7.

However, Kraft does not teach all the limitations of the claims.

In regards to claims 1 and 6, Park teaches the method according to claim 1, wherein the partial pressure of the oxygen-containing gas is less than about 40 Torr at column 11, lines 20-21.

In regards to claim 7, Park teaches the method according to claim 1 wherein the oxygen-containing gas comprises O_2 at column 7, lines 20-25.

In regards to claim 8, Park teaches the method according to claim 7, wherein the process gas further comprises N_2 at column 12, lines 67.

In regards to claim 9, Park teaches the method according to claim 8, wherein the $N_2:O_2$ flow ratio is about 3:1 at column 13, line 1.

In regards to claim 10, Park teaches the method according to claim 1, wherein the process gas further comprises an inert gas at column 7, lines 20-24.

In regards to claim 11, Park teaches the method according to claim 10, wherein the inert gas comprises at least one of Ar, He, Ne, Kr, Xe, and N₂ at column 7, lines 20-24.

In regards to claim 12, Park teaches the method according to claim 1, wherein the substrate temperature is between about 500 °C and about 1000 °C at column 7, lines 21-29.

In regards to claim 13, Park teaches the method according to claim 1, wherein the substrate temperature is about 700 °C at column 7, lines 21-29.

In regards to claim 14, Park teaches the method according to claim 1, wherein the substrate comprises Si and the oxide layer comprises SiO₂ at column 7, lines 48-52.

In regards to claim 15, Park teaches the method according to claim 1, wherein the process chamber pressure is less than atmospheric pressure at column 7, lines 41-47.

In regards to claims 16 and 17, Park teaches the method according to claim 15, wherein the process chamber pressure is less than about 50 Torr at column 11, lines 47-48.

In regards to claim 18, Park teaches the method according to claim 17, wherein the initial dielectric layer comprises at least one of an oxide layer, an oxynitride layer, an nitride layer, and a high-K layer at column 7, lines 48-52.

In regards to claim 19, Park teaches the method according to claim 18, wherein the oxide layer comprises SiO₂ at column 7, lines 48-52.

In regards to claim 20, Park teaches the method according to claim 18, wherein oxynitride layer comprises SiO_xN_y at column 7, lines 48-52.

In regards to claim 21, Park teaches the method according to claim 18, wherein the nitride layer comprises silicon nitride at column 7, lines 48-52.

In regards to claim 22, Park teaches the method according to claim 18, wherein the high-k layer comprises at least one of HfO_2 , ZrO_2 , Ta_2O_5 , TiO_2 , Al_2O_3 , and HfSiO at column 3, lines 55-57 and column 6, lines 44-52.

In regards to claim 23, Park teaches the method according to claim 17, wherein the process chamber pressure is less than about 40 Torr at column 11, lines 20-21

In regards to claim 24, Park teaches the method according to claim 17, wherein the oxygen-containing gas comprises O_2 at column 7, lines 20-25.

In regards to claim 25, Park teaches the method according to claim 24, wherein the process gas further comprises N_2 at column 12, lines 67.

In regards to claim 26, Park teaches the method according to claim 17, wherein the process gas further comprises an inert gas at column 7, lines 20-24.

In regards to claim 27, Park teaches the method according to claim 26, wherein the inert gas comprises at least one of Ar, He, Ne, Kr, Xe, and N_2 at column 7, lines 20-24.

In regards to claim 28, Park teaches the method according to claim 17, wherein the substrate temperature is between about 500°C and about 1000°C at column 7, lines 21-29.

In regards to claim 29, Park teaches the method according to claim 17, wherein the substrate temperature is about 700 °C at column 7, lines 21-29.

In regards to claim 30, Park teaches the method according to claim 17, wherein the process chamber pressure is less than atmospheric pressure at column 7, lines 41-47.

In regards to claim 31, Park teaches the method according to claim 17, wherein the process chamber pressure is less than about 50 Torr at column 11, lines 47-48.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified Kraft to include the partial pressure of the oxygen-containing gas is less than about 40 Torr; the substrate temperature is between about 500 °C and about 1000 °C; the high-k layer comprises at least one of HfO₂, ZrO₂, Ta₂O₅, TiO₂, Al₂O₃, and HfSiO; and the inert gas comprises at least one of Ar, He, Ne, Kr, Xe, and N₂, since such a modification would result in an orientation and microstructure of which can be controlled irrespective of the employment of an adhesion layer as described in column 4, lines 36-39 of Park et al.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renee R Berry whose telephone number is (571) 272-1774. The examiner can normally be reached on M-F 9-5:30.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



RRB
June 18, 2004



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